Claims

1. A method of providing a cell with herbicide resistance comprising the steps of:

providing a polynucleotide comprising polynucleotide sequences encoding the enzymes of the complete mevalonate pathway;

introducing said polynucleotide into a plurality of target cells;

contacting said cells with an herbicide that targets a component of a non-mevalonate pathway; and

selecting at least one target cell which exhibits herbicide resistance.

2. The method according to claim 1, wherein said target cell is a plant cell.

3. The method according to claim 1, wherein said target cell is a microalgae cell.

4. The method according to claim 2, wherein said polynucleotide is introduced into a plastid of said target cell.

5. The method according to claim 3, wherein said polynucleotide is introduced into a plastid of said target cell.

6. The method according to claim 1, wherein said polynucleotide further comprises a sequence encoding IPP isomerase.

7. The method according to claim 2, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

8. The method according to claim 3, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

9. The method according to claim 4, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

10. The method according to claim 5, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

11. An isolated polynucleotide encoding *R. capsulatus* IPP isomerase, said polynucleotide comprising the sequence of SEQ ID NO: 55.

12. A method for producing a transformed plant comprising the steps of:

providing a polynucleotide comprising polynucleotide sequences encoding the enzymes of the complete mevalonate pathway;

introducing said polynucleotide into a plurality of target plant cells;

selecting at least one plant cell transformed with said polynucleotide; and

regenerating said at least one plant cell into a transformed plant.

13. A method according to claim 12, wherein said polynucleotide is introduced into a plastid of said target plant cell, and wherein said plant is a transplastomic plant.

14. A plant produced by the method of claim 11.

15. A plant according to claim 14, wherein said plant is a transplastomic plant.

16. A method for providing transformed cells having increased isoprenoid production as compared to non-transformed cells, comprising the steps of:

providing an isolated polynucleotide comprising polynucleotide sequences encoding the enzymes of the complete mevalonate pathway;

providing a plurality of target cells;

introducing said isolated polynucleotide into said target cells;

selecting target cells which have been transformed with said polynucleotide; and

growing said transformed cells under conditions whereby additional generations of descendant transformed cells are produced, said transformed cells exhibiting increased isoprenoid production as compared to non-transformed cells of the same type.

17. The method according to claim 16, wherein said isolated polynucleotide further comprises the polynucleotide sequence encoding IPP isomerase.

18. The method of claim 16, wherein said target cells are microalgae.

19. The method of claim 17, wherein said target cells are microalgae.

20. The method of claim 16, further comprising the step of regenerating said transformed cells into a transformed plant, wherein said transformed plant exhibits increased isoprenoid production as compared to a non-transformed plant of the same type.

21. A plant produced by the method of claim 20.

22. Descendants of the plant of claim 21, wherein said descendants exhibit increased isoprenoid production as compared to non-transformed plants of the same type.

23. A method of providing a cell with antibiotic resistance comprising the steps of:

providing a polynucleotide comprising polynucleotide sequences encoding the enzymes of the complete mevalonate pathway;

introducing said polynucleotide into a plurality of target cells;

contacting said cells with an antibiotic that targets a component of a non-mevalonate pathway; and

selecting at least one target cell which exhibits antibiotic resistance.

24. The method according to claim 23, wherein said target cell is a plant cell.

25. The method according to claim 24, wherein said target cell is a microalgae cell.

26. The method according to claim 24, wherein said polynucleotide is introduced into a plastid of said target cell.

27. The method according to claim 25, wherein said polynucleotide is introduced into a plastid of said target cell.

28. The method according to claim 23, wherein said polynucleotide further comprises a sequence encoding IPP isomerase.

29. The method according to claim 24, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

30. The method according to claim 25, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

31. The method according to claim 26, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

32. The method according to claim 27, wherein said polynucleotide comprises a sequence encoding IPP isomerase.

33. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 58.

34. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 59.

35. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 60.

36. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 61.

37. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 62.

38. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 63.

39. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 64.

40. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 72.

41. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 73.

42. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 74.

43. The method according to claim 1, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 76.

44. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 58.

45. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 59.

46. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 60.

47. The method according to claim 12, wherein said polynucleotide comprises

the polynucleotide sequence of SEQ ID NO: 61.

48. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 62.

49. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 63.

50. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 64.

51. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 72.

52. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 73.

53. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 74.

54. The method according to claim 12, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 76.

55. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 58.

56. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 59.

57. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 60.

58. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 61.

59. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 62.

60. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 63.

61. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 64.

62. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 72.

63. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 73.

64. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 74.

65. The method according to claim 16, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 76.

66. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 58.

67. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 59.

68. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 60.

69. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 61.

70. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 62.

71. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 63.

72. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 64.

73. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 72.

74. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 73.

75. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 74.

76. The method according to claim 23, wherein said polynucleotide comprises the polynucleotide sequence of SEQ ID NO: 76.

77. An isolated polynucleotide comprising polynucleotide sequences encoding the enzymes of the complete mevalonate pathway, said polynucleotides comprising a sequence selected from the group consisting of SEQ ID NO: 58, SEQ ID NO: 59, SEQ ID NO: 60, SEQ ID NO: 61, SEQ ID NO: 62, SEQ ID NO: 63, SEQ ID NO: 64, SEQ ID

NO: 72, SEQ ID NO: 73, SEQ ID NO: 74, and SEQ ID NO: 76.

78. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 58.

79. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 59.

80. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 60.

81. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 61.

82. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 62.

83. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 63.

84. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 64.

85. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 72.

86. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 73.

87. An isolated polynucleotide according to claim 77, wherein said

polynucleotide comprises the sequence of SEQ ID NO: 74.

88. An isolated polynucleotide according to claim 77, wherein said polynucleotide comprises the sequence of SEQ ID NO: 76.

89. An isolated polynucleotide comprising the sequence of SEQ ID NO: 75.

90. A method of providing a cell with an inserted polynucleotide sequence encoding one or more products of interest comprising the steps of:

providing a plurality of target cells having an identified pseudogene site therein;

providing an isolated polynucleotide comprising polynucleotide sequences of said pseudogene site flanking at least one coding sequence of interest;

introducing said polynucleotide into a plurality of said target cells;

selecting at least one target cell which contains the coding sequence of interest inserted into said pseudogene site .

91. The method according to claim 90, wherein said pseudogene is a defunct gene located in an active operon from which monocistronic or polycistronic RNA is produced.

92. The method according to claim 91, wherein said operon is the *rpl23* operon .

93. The method according to claim 91, wherein said pseudogene is *infA*.

94. The method according to claim 90, wherein the inserted polynucleotide is operably linked to the regulatory sequences of the pseudogene.

95. The method according to claim 94, wherein the inserted polynucleotide is operably linked to the regulatory sequences of the *rpl23* operon.

96. The method according to claim 94, wherein the inserted polynucleotide is

operably linked to the regulatory sequences of *infA*.

97. The method according to claim 90, wherein the isolated polynucleotide further comprises additional flanking sequences that themselves flank the pseudogene sequences, and wherein said additional flanking sequences, in their native state, flank the pseudogene in its native state.

98. The method according to claim 97, wherein the inserted polynucleotide replaces the pseudogene in its entirety.

99. The method according to claim 97, wherein said additional flanking sequences are native plastid sequences.

100. The method according to claim 90, wherein said target cell is a plant cell.

101. The method according to claim 90, wherein said target cell is a microalgae cell.

102. The method according to claim 100, wherein said polynucleotide is introduced into a plastid of said target cell.

103. The method according to claim 101, wherein said polynucleotide is introduced into a plastid of said target cell.

104. The method according to claim 100, wherein said plant cell is selected from the group consisting of the rosids, asterids, and liliales.

105. The method according to claim 100, wherein said plant cell is from a solanaceous species.

106. The method according claim 105, wherein said plant cell is selected from the group consisting of petunia, tomato, potato, and tobacco cells.

107. The method according to claim 90, wherein said coding sequence of interest comprises polynucleotide sequences encoding the enzymes of the complete mevalonate pathway.

108. The method according to claim 90, wherein said polynucleotide further comprises a sequence encoding IPP isomerase.

109. The method according to claim 107, wherein said polynucleotide further comprises a sequence encoding IPP isomerase.

110. The method according to claim 90, wherein said polynucleotide comprises polynucleotide sequences encoding phytoene synthase.

111. The method according to claim 90, wherein said polynucleotide is promoterless.

112. A method according to any of claims 100, 102, 104, 105, and 106, said method further comprising the step of regenerating said selected target cell into a plant, said plant comprising said coding sequence of interest.

113. A plant produced by the method of claim 112.

114. Descendants of the plant of claim 113, said descendant plants comprising said coding sequence of interest.